

(1)

AD-A254 793



PROCEEDINGS

6-11-92

GRANT NO. N00014-92-J-1733

National Center for Manufacturing Sciences, Inc.  
900 Victors Way  
Ann Arbor, Michigan 48108-1779

DTIC  
ELECTE  
SEP 02 1992  
S A D

This document has been approved  
for public release and sale; its  
distribution is unlimited.

92 8 31 006

92-24089  
LIT/SC/CH  
10P8





DEPARTMENT OF THE NAVY  
OFFICE OF THE CHIEF OF NAVAL RESEARCH  
ARLINGTON, VIRGINIA 22217-5000

IN REPLY REFER TO

1512B:JGW

JUN 11 1992

National Center for Manufacturing Sciences  
900 Victors Way  
Ann Arbor, MI 48108-1779

Gentlemen:

Enclosed for your retention is one copy of Grant Number N00014-92-J-1733 which I have signed for the Government. The grant document does not require your signature.

Please acknowledge receipt of this grant by promptly signing and returning the enclosed copy of this transmittal letter to this office to the attention of Code 1512B:JGW. Keep this original letter for your records.

In the event of any disagreement with the grant provisions, you must notify this office within thirty (30) days of the date of this letter. If you have any questions, please contact Jon G. Wester by telephone on (703) 696-2600.

Sincerely,

Grants Officer

Enclosure

Acknowledgement of Receipt

By: M. Nagyjanz

DIRECTOR, NCMS  
CFO CONTRACTS

Date: 8-15-92

Accession For	
NTIS	CRA&I
DTIC	TAB
Unannounced	
Justification .....	
By .....	
Distribution /	
Availability Codes	
Dist	Avail. Codes
A-1	

DTIC QUALITY INSPECTED 3

---

**National Center for Manufacturing Sciences****900 Victors Way  
Ann Arbor, MI  
48108-1779****August 25, 1992**

**Mr. Jon Wester  
Office of Naval Research  
Contracts Division, Code 151  
800 North Quincy Street  
Arlington, VA 22217-5000**

**Subject:      Grant No. N00014-92-J-1733**

**Dear Mr. Wester:**

Enclosed, in accordance with the terms and conditions of the subject grant, are the Proceedings (with a completed Document Control Data -- R&D form [SF298]). Also enclosed is the Acknowledgment of Receipt requested by your letter of June 11.

Please do not hesitate to call if you have any questions or require additional information.

Sincerely,



**Michael Szczepeanek  
Director R&D Contracts**

**Enclosures**

**cc:      ONR (w/3 copies of proceedings & SF298)  
          DTIC (w/1 copy of proceeding & SF298)  
          W. Collins, NCMS**

---

**Board of Directors**

Chairman  
Howard A. Greis  
Kinetic Corporation

Vice Chairman  
Jack E. Swindle  
Texas Instruments, Inc.

Walter J. Aspatore  
Onset BIDCO, Inc.

Robert F. Bescher  
United Technologies  
Corporation

Don H. Davis, Jr.  
Allen-Bradley Company

John W. Fedor  
Masco Machine, Inc.

Robert A. Frosch  
General Motors  
Corporation

James L. Koontz  
Kingsbury Corporation

Gary E. Lunger  
EFCO Incorporated

Larry D. McArthur  
Aries Technology, Inc.

Michael K. McEvoy  
Baxter Healthcare  
Corporation

John P. McTague  
Ford Motor Company

Daniel J. Meyer  
Cincinnati Milacron, Inc.

Mark A. Medley  
Control Technology, Inc.

Edward A. Miller  
NCMS

E. Keith Moore  
Hurco Companies, Inc.

Wayne R. Moore  
Moore Special Tool  
Company, Inc.

Philip R. Thomas  
Thomas Group, Inc.

Lawrence G. Walker  
Digital Equipment  
Corporation

**ABSTRACT:** The NCMS and University Science Partners Holdings, Inc. (USPH) have previously agreed to work together to transfer eight key technologies from the E. O. Paton Electric Welding Institute (PWI) and the Dnepropetrovsk Metallurgical Institute (DMI) in Ukraine. The Ukrainian technologies have been well chosen and are all state-of-the-art in areas where the United States does not have a technical lead. The Ukrainian technologies are mature and attractive to the National Laboratories and sophisticated U.S. Manufacturers. The technologies of particular interest are: Electron Beam Carbides and Diamond-Like Carbon Coatings, Electron Beam Fiber Coating, Electron Beam Thermal Barrier Coatings, Gyrotron Processing of Electronic Circuit Boards, Microlaminates, Anisotropic Porous Materials, PICT-Iron and Diamond Honing.

Through discussions with the technology inventors, Government agencies and industry, the apparent need for first hand information to be presented to the NCMS membership, U.S. Government and industry was discovered. Workshops covering the technical areas identified in Ukraine were planned and executed during the months of March, April and May 1992.

# UKRAINIAN TECHNOLOGY TRANSFER PROJECT

05/15/92

## 1Q92 SUMMARY UPDATE

Following is a summary of events that detail the current status and future plans for the Ukrainian Technology Transfer Project. This project complies in full with the Technology Sourcing Operating Plan released 3 May 1992, per item 2, Global Technology Sourcing, and the Milestones & Status section of the plan regarding 1Q92 and 2Q92.

The intent of this summary is to provide an update on the continued exploitation of a unique opportunity; developing technical relationships with leading Ukrainian Research Institutes and transferring the Ukrainian technology to the NCMS industrial and government membership.

The NCMS and University Science Partners Holdings, Inc. (USPH) have previously agreed to work together to transfer eight key technologies from the E. O. Paton Electric Welding Institute (PWI) and the Dnepropetrovsk Metallurgical Institute (DMI) in Ukraine. The Ukrainian technologies have been well chosen and are all state-of-the-art in areas where the United States does not have a technical lead. The Ukrainian technologies are mature and attractive to the National Laboratories and sophisticated US Manufacturers. The technologies of particular interest are: Electron Beam Carbides and Diamond-Like Carbon Coatings, Electron Beam Fiber Coating, Electron Beam Thermal Barrier Coatings, Gyrotron Processing of Electronic Circuit Boards, Microlaminates, Anisotropic Porous Materials, PICT-Iron and Diamond Honing.

Working through the NCMS on a collaborative basis, NCMS member companies are developing technical and commercial relationships with the leading Ukrainian Institutes. A critical NCMS objective in this endeavor is to install prototype facilities with these technologies in the United States promptly.

USP Holdings, Inc. (USPH), is a corporation involved in the business of technology transfer and has been instrumental in obtaining various manufacturing technologies from research institutes in Ukraine, formerly the Union of Soviet Socialist Republics (USSR) and has been active in the formation of subsidiary ventures to promote the commercialization of those technologies. USPH is a NCMS contractor for the Ukrainian Technology Transfer Project.

### TABLE OF CONTENTS:

• Project Goal	Page 1
• Ukraine Trip	Page 2
• Ukrainian Science Workshops	Page 5

### UKRAINIAN TECHNOLOGY TRANSFER PROJECT GOAL:

Establish a collaboration between NCMS member organizations, Government Agencies and the NCMS to exploit a unique opportunity in developing technical relationships with leading Ukrainian Research Institutes. The measure of project success is determined by the percentage and timing of technology implementation into the production flow on NCMS member company factory floors. Milestones to measure technology transfer to industry will be monitored by the number of equipment purchases and the purchaser, as well as process and technology licensing.

## **SUMMARY OF UKRAINE TRIP:**

The NCMS/USPH sponsored mission to Ukraine took place during the weeks of 26 January 1992 and 2 February 1992. Representatives from United Technologies Corporation, Pratt & Whitney, the Naval Research Laboratory, USPH and NCMS participated.

The E. O. Paton Electric Welding Institute (PWI), Dnepropetrovsk Metallurgical Institute (DMI) and the Institute for Superhard Materials (ISM) were visited. Specific areas of interest included Electron Beam processing of carbide coatings, coating of fibers and thermal barrier coatings for turbine blades (PWI); gyrotron microwave processing (PWI); anisotropic porous materials - GASAR (DMI); PICT-Iron (DMI); and diamond honing (ISM).

Electron Beam coatings are divided into three categories: namely carbide coatings, fiber coatings and thermal barrier coatings. All seven areas indicated above are discussed below.

### **Electron Beam Physical Vapor Deposition of Carbides:**

- **Technical Objective:** EB-PVD process for commercial carbide coatings.
- **Applications:** Bi-metallic discs for slitters and milling cutters, TiC coatings on steel cutting tools, diamond-like carbon, vapor deposited copper on ceramic capacitor substrates (eliminates need for expensive silver electrodes), laminates and metal /ceramic composites.
- **Technical Benefits Over Existing Art:** High deposition rates, high properties.
- **Project Targets:** Optimize strength, hardness, toughness, wear resistance and conductivity of coatings.
- **Technology Transfer Objectives:**
  - Bring equipment to North America for safety upgrades and production of samples.
  - License processes.
  - Member company purchase of research units.

### **Electron Beam Physical Vapor Deposition on Fibers:**

- **Technical Objective:** Electron Beam - Physical Vapor Deposition Process for commercial fiber and Metal Matrix Composite coatings (MMC).
- **Applications:** Dispersion strengthened material for conductor applications (i.e.: Cu<sub>3</sub>Mo, PtZrO<sub>2</sub>).
- **Technical Benefits Over Existing Art:** Fast continuous process; superior wetting and thermal stability in matrix.
- **Project Targets:** Optimize coating composition, thickness, coverage and deposition rate.
- **Technology Transfer Objectives:**
  - Bring equipment to North America for safety upgrades and production of
  - License processes.
  - Member company purchase of research units.

### **Electron Beam Physical Vapor Deposition of Thermal Barrier Coatings:**

- **Technical Objective:** Electron Beam - Physical Vapor Deposition Process for Thermal Barrier Coatings on super alloys and gas turbine components.
- **Applications:** Vapor deposition of metal and ceramic coatings to protect gas turbine blades.
- **Technical Benefits Over Existing Art:** Longer life between engine overhauls, therefore, reduced cost of ownership currently estimated at 2X).
- **Project Targets:** Optimize compositions, thickness and number of layers used on blades.
- **Technology Transfer Objectives:**
  - Bring equipment to North America for safety upgrades and production of samples.
  - License processes.
  - Member company purchase of research

### **Gyrotron Microwave Processing:**

- **Technical Objective:** Fast, continuous clean process for thick films and bonding of circuit boards.
- **Applications:** Circuit boards, windows, thick films on glass (i.e.: automobile defroster), thick films on polymer (i.e.: Cu leads on PWB), thick films on ceramic; and solder paste.
- **Technical Benefits Over Existing Art:** Lower cost paste, lower operating and/or cure temperature, lower pollution process (no electrolytes, low Pb).
- **Project Targets:** Optimize gyrotron processing parameters of electronic components. Optimize adhesives and pastes.
- **Technology Transfer Objectives:**
  - Bring equipment to North America for safety upgrades and production of samples.
  - LANL as beta site for gyrotron safety/control upgrade and CRADA.
  - Member company purchase of research units.

### **Anisotropic Porous Materials:**

- **Technical Objective:** Optimize process for commercial production of unique materials.
- **Applications:** Ni tubes of insulin filters, Ni filters for chemical plants (in service one year, replaces sintered Cu filters that last one week), bronze bearings for food processing (prevents food contamination), ceramic catalyst support (high temperature application), Mg space structures.

- **Technical Benefits Over Existing Art:** Less wear, high strength-to-weight, more damping, better filter, high conductivity.
- **Project Targets:** Optimize strength, thermal conductivity, wear resistance and damping.
- **Technology Transfer Objectives:**
  - Bring equipment to North America for safety upgrades and production of samples.
  - License processes.
  - Member company purchase of research units.

**PICT-Iron:**

- **Technical Objective:** Optimize processing and heat treatment for various applications.
- **Applications:** Cam rods, bearings, rolls, grinding balls, knives, etc.
- **Technical Benefits Over Existing Art:** Low cost, low wear, high hardness. Does not require special equipment or unconventional operations. 3-4X lifetime improvement on cast iron rolls.
- **Project Targets:** Optimize strength, hardness, toughness and wear resistance damping.
- **Technology Transfer Objectives:** License process to US. producer.

**Diamond Honing:**

- **Technical Objective:** Qualify honing for machining wear surfaces.
- **Applications:** Cylinders, liners in a variety of engines, pumps and compressors.
- **Technical Benefits Over Existing Art:** Provide engineered surfaces with less wear, lower friction, less oil and gas.
- **Project Targets:** Advertised production ready device. Demonstrate 5X increase in service life of honed parts.
- **Technology Transfer Objectives:**
  - Demonstrate equipment at ITI.
  - Machine samples for member companies.
  - Market tools.

The information illustrated in the seven fields of interest above were identified and focused as a result of the Ukraine trip in January and February 1992. A follow-up trip is scheduled for June and July 1992 to further focus technology samples and business direction.

## **UKRAINIAN SCIENCE WORKSHOPS:**

One result of the trip to Ukraine, and through subsequent discussions with the technology inventors, was the apparent need for first hand information to be presented to the NCMS membership, US. Government and industry. Workshops covering the technical areas identified in the Ukraine Trip section were planned and executed during the months of March, April and May 1992 per the following plan:

<b><u>WORKSHOP</u></b>	<b><u>LOCATION</u></b>	<b>ATT.</b>	<b>DATE</b>
• Anisotropic Porous Materials Workshop	Marriott @ National Airport	35	3/24/92
• Anisotropic Porous Materials Workshop	Wright Patterson Air Force Base	25	3/26/92
• Electron Beam & Diamond Honing Workshop	Naval Surface Warfare Center	27	4/13/92
• Electron Beam & Diamond Honing Workshop	Wright Patterson Air Force Base	22	4/15/92
• Gyrotron Microwave Processing Workshop	Naval Surface Warfare Center	23	5/5/92
• Gyrotron Microwave Processing Workshop	Wright Patterson Air Force Base	22	5/7/92

These workshops were co-sponsored by the NCMS and the Office of the Chief of Naval Research. Following is a list of NCMS members, Government Agencies and industrial companies that attended the workshops:

### **GOVERNMENT ORGANIZATIONS**

CDNSWC  
Department of Commerce  
DTRC  
FSTC  
Joint Economic Committee  
NAEC  
NAS  
NASA  
NASP  
NAWC  
NIST  
NRL  
NSWC  
NUSC  
OCNR  
OSD  
U.S. Army  
USAF 4950 TW

### **INDUSTRIAL ORGANIZATIONS**

3M  
Armco  
Boeing  
Carnahan and Associates  
Chromalloy  
DIA  
EG&G  
Fiber Materials Inc.  
General Dynamics  
General Electric  
General Motors- Allison / Harrison  
Howmet  
IDA  
Martin Marietta  
Space Age Concepts  
Sverdrup  
University of Maryland  
UTC, P&W  
Varian

All costs associated with the Ukrainian Technology Transfer Workshops were completed in compliance with the approved proposal entitled: "A Technical and Cost Proposal for Importing Ukrainian Technologies to the U.S. Navy and North American Industry".

**PART 53—FORMS**

SI.301-298

<b>REPORT DOCUMENTATION PAGE</b>			<b>Form Approved OMB No. 0704-0182</b>
<small>Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Washington Headquarters Services, Directorate for Information Operations and Support, Room 1010, Arlington, VA 22202, and to the Office of Management and Budget, Government Paperwork Elimination Program, Washington, DC 20503.</small>			
1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED	
	June 1992	Final: March 92 - May 92	
4. TITLE AND SUBTITLE		5. FUNDING NUMBERS	
Ukrainian Technology Transfer Workshops			
6. AUTHORIZEE			
William J. Collins III			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER	
National Center for Manufacturing Sciences 900 Victors Way Ann Arbor, Michigan 48108-1779			
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
Office of the Chief of Naval Research Code 00IN 800 North Quincey Street Arlington, Virginia 22217-5000			
11. SUPPLEMENTARY NOTES			
Prepared in cooperation with University Science Partners Holdings Company			
12. DISTRIBUTION/AVAILABILITY STATEMENT		13. DISTRIBUTION CODE	
Available to public			
14. ABSTRACT (Limit 200 words)			
Reference attachment			
16. SUBJECT TERMS		17. NUMBER OF PAGES	
Ukrainian Technology Transfer Workshops		7	
18. PRICE CODE			
19. SECURITY CLASSIFICATION OF REPORT	20. SECURITY CLASSIFICATION OF THIS PAGE	21. SECURITY CLASSIFICATION OF ABSTRACT	22. LIMITATION OF ABSTRACT
REF ID: A6140-01-280-2500			

Standard Form 298 (Rev. 2-85)  
GSA FPMR (41 CFR) 101-11.7  
2000-05-01